

### Warm Up # 4-2

1. Use the shortcut to expand:  $(x - 3)^5$
2. Describe the transformations and accurately sketch the graph of

$$f(x) = 2(3)^{(x-1)} - 4$$

**HW Questions:** p. 307

### EXERCISE 10B

- 1  $X$  is a random variable that is distributed normally with mean 70 and standard deviation 4. Find:
  - a  $P(70 \leq X \leq 74)$
  - b  $P(68 \leq X \leq 72)$
  - c  $P(X \leq 65)$

- 4 Suppose  $X \sim N(37, 7^2)$ .
  - a Use technology to find  $P(X > 40)$ .
  - b Hence find  $P(37 \leq X \leq 40)$  without technology.

5 A manufacturer makes nails which are supposed to be 50 mm long. In reality, the length  $L$  of the nails is normally distributed with mean 50.2 mm and standard deviation 0.93 mm. Find:

a  $P(L \geq 50)$

b  $P(L \leq 51)$

c  $P(49 \leq L \leq 50.5)$

6 A machine produces metal bolts. The lengths of these bolts have a normal distribution with mean 19.8 cm and standard deviation 0.3 cm. If a bolt is selected at random from the machine, find the probability that it will have a length between 19.7 cm and 20 cm.

- 7** Max's customers put money for charity into a collection box in his shop. The average weekly collection is approximately normally distributed with mean \$40 and standard deviation \$6.
- a** In a randomly chosen week, find the probability of Max collecting:
    - i** between \$30.00 and \$50.00
    - ii** at most \$32.00 .
  - b** In a 52 week year, in how many weeks would Max expect to collect at least \$45.00?

- 8** Eels are washed onto a beach after a storm. Their lengths have a normal distribution with mean 41 cm and standard deviation 5.5 cm.
- a** If an eel is randomly selected, find the probability that it is at least 50 cm long.
  - b** Find the proportion of eels measuring between 40 cm and 50 cm long.
  - c** How many eels from a sample of 200 would you expect to measure at least 45 cm in length?

- 9 The speed of cars passing the supermarket is normally distributed with mean  $56.3 \text{ km h}^{-1}$  and standard deviation  $7.4 \text{ km h}^{-1}$ . Find the probability that a randomly selected car has speed:
- a between 60 and  $75 \text{ km h}^{-1}$       b at most  $70 \text{ km h}^{-1}$       c at least  $60 \text{ km h}^{-1}$ .

p. 308

Consider a population of crabs where the length of a shell,  $X$  mm, is normally distributed with mean 70 mm and standard deviation 10 mm.

A biologist wants to protect the population by allowing only the largest 5% of crabs to be harvested. He therefore asks the question: "95% of the crabs have lengths less than what?".

To answer this question we need to find  $k$  such that  $P(X \leq k) = 0.95$ .

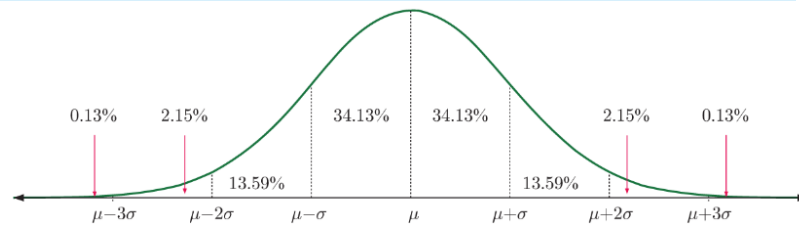
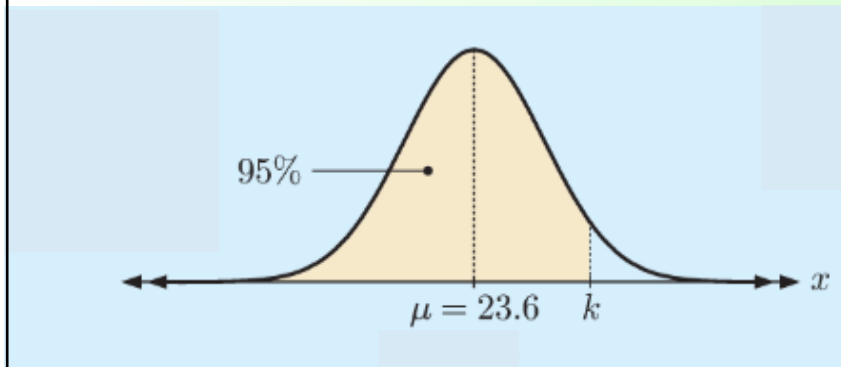
The number  $k$  is known as a **quantile**, and in this case the 95% quantile.

When finding quantiles we are given a probability and are asked to calculate the corresponding measurement. This is the *inverse* of finding probabilities, and we use the **inverse normal function** on our calculator.



$$X \sim N(23.6, 3.1^2)$$

$$P(X \leq k) = 0.95$$



## Calculating Inverse Normal

to find  $k$ , given:

$$X \sim N(23.6, 3.1^2)$$

$$P(X \leq k) = 0.95$$

**2nd** **DISTR**  
**VARs**

invNorm (0.95, 23.6, 3.1)

$\mu$   $\sigma$

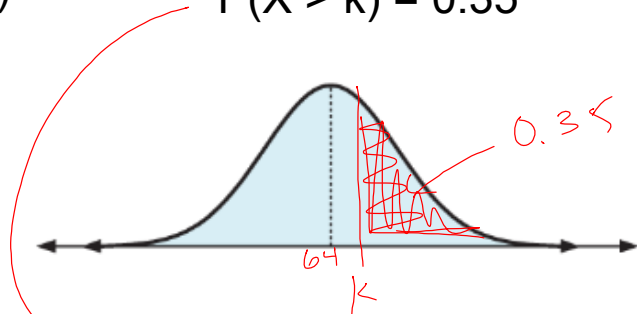
probability

$$k \approx 28.7$$

Another Example, illustrate and find k

$$X \sim N(64, 3^2)$$

$$P(X > k) = 0.35$$



$$= P(X \leq k) = 0.65$$

$$\text{InvNorm}(0.65, 64, 3)$$

$$k \approx 65.2$$

HW: 10C p. 309, # 1 - 9

and

on a separate piece of paper:

Write down three possible topics for your project. Write a brief statement about how they are of interest to you. For each topic, say whether you think you will find existing data or if you think you will need to generate your own data.